Although the book is written from the point of view of American practice, and consequently certain sections, such as the chapter on estimates and costs, will not be found so useful to English workers, the general information on constructional work, which is mainly descriptive, should be found helpful by students and those engaged in English practice.

(3) The authors have performed the unenviable task of condensing the whole problem of sewerage and sewage disposal within fifty-six small pages, in such a manner as to give the lay mind a good and, on the whole, fairly accurate elementary idea of the subject. It necessarily follows that the information afforded will not be found so useful to those actually engaged in sewage work.

In view of the adverse opinion expressed in Dunbar's "Principles of Sewage Treatment," it is interesting to note that the authors strongly advocate the preliminary treatment of sewage in aërobic slate filters.

EDWARD ARDERN.

OUR BOOK SHELF.

Explication méchanique des Propriétés de la Matière, Cohésion, Affinité, Gravitation, &c. By A. Despaux. Pp. 352. (Paris: Félix Alcan, 1908.) Price 6 francs.

THIS is an attempt to explain everything in terms of a mechanical hypothesis. The universality of application of his hypothesis is scarcely conveyed by the author in the title he has given to his book. Not only cohesion, affinity, gravitation, but also biological and psychological problems are brought within its range. What differences of opinion, therefore, may we not expect from those who read its pages! Such far-reaching generalisations must be backed up by exceptionally strong evidence before their acceptance can be reasonably entertained.

The author seems to anticipate that it will not be easy to secure adhesion to his views. He has little respect for what we may call the grand reserve of science. Official science, he says, is essentially conservative. When a discovery is made, it is said at first that it is not true; and then that it is not new. To some extent he is able to justify his belief in the "resistance" of science. Said Lavoisier, "I do not expect that my ideas will be adopted all at once." While he explained combustion by a simple combination, the partisans of phlogiston burned his effigy in Berlin. Avogadro received no attention from the French Academy, to which he presented his memoir, and it was only twenty years afterwards that he obtained recognition. Sadi Carnot's memoir remained unknown until, after twenty-four years, Lord Kelvin rescued it from oblivion.

Our author, therefore, does not expect impartiality from his contemporaries; it scarcely seems worth while to state our opinion upon his views. We will be content with indicating that he attempts to show that everything can be explained by supposing the molecule to consist of a sort of corkscrew which, spinning, sets up whirls and streams in the æther which he likens to those produced by a ventilating fan. If the molecule is "free," then by its own rotation it propels itself in space "like a fish in water or a bird in the air." It is then part of a gas. When it is part of a solid it is fixed in position, but by its rotation propels æther in front and sucks it in behind. This flow of æther through the molecule constitutes the electric charge; and so on; but for the remainder of this explanation of the universe we must refer the unbiassed reader to the volume itself.

Leçons de Physique générale. By J. Chappuis and A. Berget. Tome I. Second edition; completely revised. Pp. xii+669; illustrations. (Paris: Gauthier-Villars, 1907.) Price 10 francs.

IN a publishers' note it is claimed that the intention of this work is to fill up the gap between elementary treatises and those in which the exposition of physics is carried to its highest developments. With regard to any such works, of which numerous examples might be cited outside France, we may say there must necessarily be considerable resemblance one with another. It is in the higher developments that originality can come chiefly into evidence; so that it is not in any derogatory spirit that we assert that there is much in this book which can be obtained elsewhere, and which in such other places is as well presented as we find it here. But it would give quite an erroneous notion as to the contents of the volume if we were to be content with such an appraisement as this. For in many parts the treatment is so lucid, considering the difficulty of the matter, that we doubt whether it is possible to find a *better* book than this of the standard which it aims at attaining. It is specially rich in illustrations of classical apparatus employed in determinations for physical data.

The chapters dealing with thermodynamics are also exceedingly clear, and will be greatly appreciated by those who have mastered the mathematics necessary—which, it must be pointed out, is never very severe. The logic is beyond criticism, and the physical conceptions are accurate. We will only add that the present volume deals with measuring instruments, weight, elasticity, statics of liquids and gases, and heat. The second edition of the volume on electricity and magnetism has already appeared.

Biochemie. Ein Lehrbuch für Mediziner, Zoologen und Botaniker. By Dr. F. Röhmann. Pp. xvi+768. (Berlin: Julius Springer, 1908.) Price 20 marks.

PROF. RÖHMANN is a well-known physiological chemist, and has produced a work on that subject which will prove useful to teachers and students of that branch of science. The book is written from the standpoint of chemistry, and really is a text-book of organic chemistry which deals particularly with the substances found in animal and vegetable organisms. The biological and metabolic aspects of the subject are treated incidentally and, as a rule, with brevity. There is, for instance, no chapter that deals with the blood as a whole, but the pigment is dealt with in one place, the proteins in another, and so forth. The same is true for milk, urine, and the other secretions; there is no general survey of ferment action, of coagulation, of oxidation, and of other processes important from the point of view of the physiologist.

There are, however, many handbooks of biochemistry available to-day which deal adequately with its biological side. Prof. Röhmann's book is therefore useful as supplementary to these from the purely chemical side. To those engaged in research his book will be a great help; it contains a mine of bibliographical references, and chemical methods of analysis are described in detail. The pages bristle with chemical formulæ which make the book somewhat formidable to medical readers, to whom the book

is partly addressed, and render it unsuitable for continuous reading except to those already well versed in organic chemistry. But to those who desire to find the latest authoritative information of a chemical kind it will prove an excellent work of reference.

W. D. H.

Geometry, Theoretical and Practical. Part iii. By W. P. Workman and A. G. Cracknell. Pp. ix+66. (London: W. B. Clive, 1908.) Price 1s. 6d.

THIS part of Messrs. Workman and Cracknell's textbook deals with the subject-matter of Euclid, book xi., on modern lines, and contains also an elementary account of the parallelepiped, sphere, and tetrahedron. The characteristics of previous parts are well maintained; the brevity of treatment and the conciseness of arrangement will appeal specially to examination candidates.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The γ Rays of Uranium.

OUR knowledge of the γ rays of uranium has until now been confined to their discovery by Rutherford (*Phys. Zeit.*, 1902, 517) and to the observations of Eve (*ibid.*, 1907, 185). The latter directed attention to their extraordinary feebleness and to their relatively low penetrating power. Eve found that uranium gives out only about one-tenth as much γ radiation as thorium when examined through 0·64 cm. lead, which is most remarkable, considering that it gives about six times more β radiation. Whereas the γ rays of thorium have the same value for the absorption coefficient as those of radium [$\lambda(\text{cm.})^{-1}$= from 0·57 to 0·46 over a range of from 0·64 cm. to 3·0 cm. of lead], the uranium γ rays are far more easily absorbed. Eve gave the value 1·4 for λ for thicknesses of lead between 0·28 cm. and 0·92 cm. He stated that the radiation was homogeneous, that the absorption was exponential over this range, and that the rays were practically completely absorbed in 1 cm. of lead. He worked with uranyl nitrate.

Having at our disposal 50 kilograms of pure uranyl nitrate, provided by the generosity of a friend in connection with the work of one of us on the parent of radium (NATURE, January 28, 366), we have been able greatly to extend and in part to correct the work on the uranium γ rays. By a long sequence of chemical operations, known and new, but based largely on the magnificent chemical work of Sir William Crookes, who discovered the substance (Proc. Roy. Soc., 1900, lxvi., 409), we separated by far the greater part of the uranium X from the uranium, and obtained it, in the last separation, in the form of films weighing only a few milligrams. The operations absorb about twelve days. Uranium X contributes, as first shown by one of us (Trans. Chem. Soc., 1902, 860), none of the α rays, but all the β rays of the uranium, and, as is to be expected, and as the present work shows, the γ rays also. These have been found to decay at the same rate as the β radiation, namely, to one-half every twenty-two days. The initial β radiation of the bare preparation lit up an X-ray screen to about the same extent as 7 mg. of pure radium bromide contained in a sealed thin glass tube. The luminosity could be plainly seen in a fully lighted room when the screen was held in the shadow of the observer; but as Eve found, the γ radiation is extraordinarily feeble. It was accurately compared with that from a known quantity of pure radium bromide after passage through 2·5 cm. of lead by means of an electroscope. Under these conditions the uranium X was equivalent to 0·053 mg. of radium bromide. As shown later, it can be calculated that the lead screen cut down the γ rays of the uranium X to 20·6 per cent., and of the radium to 55 per cent., of their initial values. From these data, allowing for the decay during the processes of separation, it may be provisionally estimated that the radiation of the two elements, uranium and radium, is about as one to five hundred million when, as in the present case, absorption is eliminated and only the hard γ rays dealt with.

Before the activity of the preparation decayed too far we were able to determine accurately the absorption coefficient of the γ rays in fourteen substances. As Wigger found for the γ rays of radium (*Jahrb. Radioakt.*, 1905, 430), the absorption follows a strict exponential law after a certain initial thickness of substance has been penetrated, and the absorption coefficient is very nearly proportional to the density of the substance. Thus for lead between the thicknesses of 1 cm. and 5 cm.—and for all other substances over corresponding thicknesses—the absorption is within the very small limit of experimental error absolutely exponential. The value of the absorption coefficient, $\lambda\,(\text{cm.})^{-1}$, for lead is 0·62. In general, for all substances the value of λ/d, where d is the density, is about 0·055, as compared with 0·021 for the radium γ rays for thicknesses greater than 2·8 cm. of lead (Wigger). Thus the uranium γ rays are about two and a half times more strongly absorbed than those of radium.

The conditions of the experiment are of fundamental importance, as they affect very much the value obtained for the absorption coefficient. In our experiments the disposition was in the main similar to that of Wigger, in that the absorbing plates were clamped up tightly to form the base of the electroscope, and the preparation was placed in a definite position beneath. For insulators the upper surface was covered with a thin leaf of aluminium. Whenever practicable, the absorbing plates were all of the same material. Only for light substances, and for one experiment with mercury, was the base of the electroscope a plate of lead as in Wigger's experiments. Its thickness was 1·2 cm.

Our value for the absorption coefficient is entirely different from that given by Eve, and, indeed, it is a little doubtful what rays Eve observed. Over the range of thickness of lead he used, from 0·28 cm. to 0·92 cm., we find that the rays are not homogeneous, and the exponential law does not hold at all. There is present in relatively great intensity a *very* much less penetrating radiation, completely absorbed by 1 cm. of lead, with a value for λ from eight to ten times greater than for the penetrating type. The absorption and magnetic deviability of these rays are under examination. They would have been far less prominent relatively in Eve's measurements with uranyl nitrate than in ours with uranium X, owing to the strong absorption in the former case. It may be mentioned that the existence is to be anticipated of a very soft γ radiation corresponding to the extremely soft β radiation of uranium X (Schlundt and Moore, Levin, H. W. Schmidt). There appears to be no radiation corresponding with Eve's value of λ, but then his value for the γ rays of radium, 0·46, is about as different from Wigger's, 0·24, as his value for the uranium γ rays, 1·4, is from ours, 0·62.

The value found in our experiments for λ/d, 0·055, was actually obtained exactly for substances so different in density and nature as mercury, lead, aluminium, slate, and pine-wood, showing the remarkable range of the "density law" in this case. At the same time, we do not think it holds strictly, for brass (density 8·40) actually absorbed more than copper (8·80), and zinc (7·07) more than tin (7·25), in experiments which were strictly comparable and under good conditions. The actual experimental values of λ/d obtained varied within the extremes of 0·045 (one value for iron) and 0·068 (paraffin wax). Part of this variation, but not, we think, the whole, is doubtless due to experimental error. Although the exponential law holds, so far as we can see, quite strictly, the values obtained for λ appear to depend somewhat on the particular experiment in an as yet not completely explained way. We propose carrying out similar experiments with the γ rays of radium, in the hope of obtaining further light on the nature of the variation.

Beyond 5 cm. of lead, and corresponding thicknesses of other metals, λ appears to change and to become very